

CLAIMS

What is claimed is:

1. A motor vehicle, comprising:

a powertrain operable for generating drive torque;

a primary driveline for transmitting drive torque from said powertrain to first and second primary wheels;

a secondary driveline for selectively transmitting drive torque from said powertrain to first and second secondary wheels, said secondary driveline including an input shaft driven by said powertrain, a first axleshaft driving said first secondary wheel, a second axleshaft driving said second secondary wheel, and a drive mechanism coupling said input shaft to said first and second axleshafts, said drive mechanism including a differential assembly, a planetary gear assembly, and first and second mode clutches, said differential assembly having an input component driven by said input shaft, a first output component driving said first axleshaft and a second output component driving said second axleshaft, said planetary gear assembly having first and second gearsets, said first gearset having a first sun gear, a first ring gear, a first planet carrier driven by said input component, and a set of first planet gears rotatably supported by said first planet carrier and meshed with said first sun gear and said first ring gear, said second gearset having a second sun gear, a second ring gear driven by said first planet carrier, a second planet carrier driven by said first axleshaft, and a set of second planet gears rotatably supported by said second planet carrier and meshed with said second sun gear and said second ring gear, said first mode clutch is operable for selectively inhibiting rotation

of said first sun gear so as to cause said planetary gear assembly to decrease the rotary speed of said first axleshaft, and said second mode clutch is operable for selectively inhibiting rotation of said second sun gear so as to cause said planetary gear assembly to increase the rotary speed of said first axleshaft; and

a control system for controlling actuation of said first and second mode clutches.

2. The motor vehicle of Claim 1 wherein said drive mechanism is operable to establish an overdrive mode when said first mode clutch is engaged and said second mode clutch is released such that said first axleshaft is overdriven relative to said input component of said differential assembly for causing said second axleshaft to be driven at a reduced speed relative to said first axleshaft.

3. The motor vehicle of Claim 2 wherein said drive mechanism is operable to establish an underdrive mode when said second mode clutch is engaged and said first mode clutch is released such that said first axleshaft is underdriven relative to said input component of said differential assembly for causing said second axleshaft to be driven at an increased speed relative to said first axleshaft.

4. The motor vehicle of Claim 1 wherein said drive mechanism is operable to establish a locked four-wheel drive mode when both of said first and second mode clutches are engaged.

5. The motor vehicle of Claim 1 wherein said input shaft includes a pinion gear driving a hypoid ring gear, and wherein said differential assembly includes a differential carrier connected to said first planet carrier and driven by said hypoid ring gear, a first sidegear fixed for rotation with said first axleshaft, a second sidegear fixed for rotation with said second axleshaft, and pinion gears rotatably supported by said differential carrier and in meshed engagement with both of said first and second sidegears.

6. The motor vehicle of Claim 1 wherein said input shaft includes a pinion gear driving a hypoid ring gear, and wherein said differential assembly includes a third ring gear driven by said hypoid ring gear, a third sun gear fixed for rotation with said first axleshaft, a differential carrier connected to said first planet carrier and fixed for rotation with said second axleshaft, a set of first pinions supported by said differential carrier and meshed with said third ring gear, and a set of second pinions supported by said differential carrier and meshed with said third sun gear, said first and second pinions arranged in meshed pairs.

7. A drive axle assembly for use in a motor vehicle having a powertrain and first and second wheels, comprising:
 - an input shaft driven by the powertrain;
 - a first axleshaft driving the first wheel;
 - a second axleshaft driving the second wheel;
 - a differential assembly having a pinion carrier driven by said input shaft and supporting pinions thereon, a first sidegear meshed with said pinions and fixed for rotation with said first axleshaft, and a second sidegear meshed with said pinions and fixed for rotation with said second axleshaft;
 - a first gearset having a first sun gear, a first ring gear, a first planet carrier fixed for rotation with said pinion carrier, and first planet gears rotatably supported by said first planet carrier and meshed with said first sun gear and said first ring gear;
 - a second gearset having a second sun gear, a second ring gear fixed for rotation with said first planet carrier, a second planet carrier fixed for rotation with said first axleshaft, and second planet gears rotatably supported by said second planet carrier and meshed with said second sun gear and said second ring gear;
 - a first mode clutch for selectively inhibiting rotation of said first sun gear;
 - a second mode clutch for selectively inhibiting rotation of said second sun gear; and
 - a control system for controlling actuation of said first and second mode clutches.

8. The drive axle assembly of Claim 7 wherein said first mode clutch is operable in a first mode to permit unrestricted rotation of said first sun gear and in a second mode to prevent rotation of said first sun gear, wherein said second mode clutch is operable in a first mode to permit unrestricted rotation of said second sun gear and in a second mode to prevent rotation of said second sun gear, and wherein said control system is operable for controlling shifting of each of said first and second mode clutches between its corresponding first and second modes.

9. The drive axle assembly of Claim 8 wherein an overdrive mode is established when said first mode clutch is in its second mode and said second mode clutch is in its first mode such that said first axleshaft is driven at an increased rotary speed relative to said pinion carrier which causes said pinions to drive said second axleshaft at a corresponding decreased rotary speed relative to said pinion carrier.

10. The drive axle assembly of Claim 8 wherein an underdrive mode is established when said first mode clutch is in its first mode and said second mode clutch is in its second mode such that said first axleshaft is driven at a reduced rotary speed relative to said pinion carrier which causes said pinions to drive said second axleshaft at a corresponding increased rotary speed.

11. A drive axle assembly for use in a motor vehicle having a powertrain and first and second wheels, comprising:

an input shaft driven by the powertrain;

a first axleshaft driving the first wheel;

a second axleshaft driving the second wheel;

a first gearset having a first ring gear driven by said input shaft, a first sun gear fixed for rotation with said first axleshaft, a first carrier fixed for rotation with said second axleshaft, and meshed pairs of first and second planet gears rotatably supported by said first carrier, said first planet gears are meshed with said first sun gear and said second planet gears are meshed with said first ring gear;

a second gearset having a second sun gear, a second ring gear, a second carrier fixed for rotation with said first carrier, and third planet gears rotatably supported by said second carrier and meshed with said second sun gear and said second ring gear;

a third gearset having a third sun gear, a third ring gear fixed for rotation with said second carrier, a third carrier fixed for rotation with said first axleshaft, and fourth planet gears rotatably supported by said third carrier and meshed with said third sun gear and said third ring gear;

a first mode clutch for selectively inhibiting rotation of said second sun gear;

a second mode clutch for selectively inhibiting rotation of said third sun gear;

and

a control system for controlling actuation of said first and second mode clutches.

12. The drive axle assembly of Claim 11 wherein said first mode clutch is operable in a first mode to permit unrestricted rotation of said second sun gear and in a second mode to prevent rotation of said second sun gear, and wherein said second mode clutch is operable in a first mode to permit unrestricted rotation of said third sun gear and in a second mode to prevent rotation of said third sun gear, said control system operable for controlling shifting of each of said first and second mode clutches between its corresponding first and second modes.

13. The drive axle assembly of Claim 12 wherein an overdrive mode is established when said first mode clutch is in its second mode and said second mode clutch is in its first mode such that said first axleshaft is driven at an increased speed relative to said first carrier which causes said second axleshaft to be driven at a decreased speed relative to said first carrier.

14. The drive axle assembly of Claim 12 wherein an underdrive mode is established when said first mode clutch is in its first mode and said second mode clutch is in its second mode such that said first axleshaft is driven at a reduced speed relative to said first carrier which causes said second axleshaft to be driven at an increased speed relative to said first carrier.

15. A transfer case for a four-wheel drive vehicle having a powertrain and first and second drivelines, comprising:

an input shaft driven by the powertrain;

a first output shaft driving the first driveline;

a second output shaft driving the second driveline;

a torque transfer mechanism operably interconnecting said input shaft to said first and second output shafts, said torque transfer mechanism including a differential assembly, a planetary gear assembly, and first and second mode clutches, said differential assembly having an input component driven by said input shaft, a first output component driving said first output shaft and a second output component driving said second output shaft, said planetary gear assembly having first and second gearsets, said first gearset having a first sun gear, a first ring gear, a first planet carrier driven by said input component, and a set of first planet gears rotatably supported by said first planet carrier and meshed with said first sun gear and said first ring gear, said second gearset having a second sun gear, a second ring gear driven by said first planet carrier, a second planet carrier driven by said first axleshaft, and a set of second planet gears rotatably supported by said second planet carrier and meshed with said second sun gear and said second ring gear, said first mode clutch is operable for selectively inhibiting rotation of said first sun gear for decreasing the rotary speed of said first output shaft, and said second mode clutch is operable for selectively inhibiting rotation of said second sun gear for increasing the rotary speed of said first axleshaft; and

a control system for controlling actuation of said first and second mode clutches.

16. The transfer case of Claim 15 wherein said torque transfer mechanism is operable to establish an overdrive mode when said first mode clutch is engaged and said second mode clutch is released such that said first output shaft is overdriven relative to said input component of said differential assembly for causing said second output shaft to be driven at a reduced speed relative to said first output shaft.

17. The transfer case of Claim 15 wherein said torque transfer mechanism is operable to establish an underdrive mode when said second mode clutch is engaged and said first mode clutch is released such that said first output shaft is underdriven relative to said input component of said differential assembly for causing said second output shaft to be driven at an increased speed relative to said first output shaft.

18. The transfer case of Claim 15 wherein said torque transfer mechanism is operable to establish a locked four-wheel drive mode when both of said first and second mode clutches are engaged.

19. A power transfer assembly for use in a motor vehicle having a powertrain and first and second drivelines, comprising:

an input shaft driven by the powertrain;

a first shaft driving the first driveline;

a second shaft driving the second driveline;

a differential assembly having an input member driven by said input shaft, a first output member fixed for rotation with said first shaft, and a second output member fixed for rotation with said second shaft;

a first gearset having a first sun gear, a first ring gear, a first carrier fixed for rotation with said second output member, and first planet gears rotatably supported by said first carrier and meshed with said first sun gear and said first ring gear;

a second gearset having a second sun gear, a second ring gear fixed for rotation with said first carrier, a second carrier fixed for rotation with said first shaft, and second planet gears rotatably supported by said second carrier and meshed with said second sun gear and said second ring gear;

a first mode clutch for selectively inhibiting rotation of said first sun gear;

a second mode clutch for selectively inhibiting rotation of said second sun gear; and

a control system for controlling actuation of said first and second mode clutches.

20. The power transfer assembly of Claim 19 wherein said first mode clutch is operable in a first mode to permit unrestricted rotation of said first sun gear and in a second mode to prevent rotation of said first sun gear, wherein said second mode clutch is operable in a first mode to permit unrestricted rotation of said second sun gear and in a second mode to prevent rotation of said second sun gear, and wherein said control system is operable for shifting said first and second mode clutches between their corresponding first and second modes.

21. The power transfer assembly of Claim 20 wherein a four-wheel drive mode is established when said first mode clutch is in its second mode and said second mode clutch is in its first mode such that said first shaft is driven at an increased speed relative to said input member which causes said second shaft to be driven at a corresponding decreased speed.